Remarks

Claims 1, 2, 4-8, 11-15, 18-21, 23, 24, 27-29, 36, and 40 are pending. Claims 1, 2, 4-8, 11-15, 18-21, 23, 24, 27-29, 36, and 40 are rejected.

Claims 1, 5-8, 21, 28, and 29 have been amended. No new matter has been added. See, e.g., Application, p. 6, ll. 20-26. Claim 11 has been cancelled.

The drawings are objected to under 37 C.F.R. 1.83(a).

Applicant's Attorney brings to Examiner's attention 120 of Figure 6 and 106 of Figure 4 of the Application. Applicant's Attorney also notes that the Applicant does not claim "means" for measuring the elasticity of the material in contact with the microbubble based on the movement of the microbubble. The drawings comply with 37 C.F.R. 1.83(a).

Claims 5, 20, and 28 are rejected under 35 U.S.C. 112, first paragraph.

With regard to claims 5 and 28, Applicant's Attorney reminds Examiner that a radiation force is due to the absorption or reflection of an acoustic wave and depends on the average amplitude of the acoustic wave. As such, a substantially continuous radiation force can be exerted by applying a continuous acoustic wave, e.g., sine wave, to a microbubble. See, e.g., Appendix: Leighton, The Acoustic Bubble, pp. 19-22.

With regard to claim 20, Applicant's Attorney brings to Examiner's attention page 9, lines 5-8 of the Application: "The shock wave associated with microbubble creation (i.e., an acoustic shock wave is launched simultaneous with mircobubble creation during a photodisruption event) can be used as a high frequency, high precision acoustic source."

Claims 5, 20, and 28 are patentable under 35 U.S.C. 112, first paragraph.

Claims 5, 7, 8, 11-14, 28, and 36 are rejected under 35 U.S.C. 112, second paragraph.

With regard to claims 5 and 28, Applicant's Attorney relies on the explanation above with respect to Examiner's rejection of claims 5 and 28 under 35 U.S.C. 112, first paragraph.

With regard to claim 7, Applicant does not claim "a force in the micro-Newton level" as suggested by Examiner, Office Action, February 2, 2007, p. 2. Rather, Applicant claims, *inter alia*, "a force in the $1x10^{-9}$ Newton to $1x10^{-6}$ Newton level." Contrary to Examiner's assertions, $5x10^{9}$ Newtons cannot be a force in the $1x10^{-9}$ Newton to $1x10^{-6}$ Newton level.

With regard to claim 8, Applicant's Attorney relies on the explanation above with respect to Examiner's rejection of claim 7 under 35 U.S.C. 112, second paragraph.

With regard to claims 14 and 36, Applicant's Attorney reminds Examiner that a microbubble having a diameter of less than 1 μm is a nanobubble. See, e.g., Appendix: Unger et. al., Microbubbles in molecular imaging and therapy, pp. 58-65.

Examiner has not explained why claims 12 and 13 are rejected under 35 U.S.C. 112, second paragraph. Applicant's Attorney assumes Examiner mistakenly listed claims 12 and 13 in this rejection.

Claims 5, 7, 8, 12-14, 28, and 36 are patentable under 35 U.S.C. 112, second paragraph.

Claims 1, 2, 4-8, 11, 13-15, 19-21, 23, 24, 27-29, and 36 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Pat. No. 6,932,914 (LeClair). Claims 18 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over LeClair in view of U.S. Pat. No. 6,605,453 (Ozkan). Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ozkan in view of LeClair.

With regard to amended claims 1 and 21, LeClair does not teach propagating at least one acoustic wave through the material to exert a radiation force at an exterior surface of the microbubble to displace a central portion of the microbubble within the material without causing the destruction of the microbubble. Rather, LeClair attempts to control and direct a re-entrant micro-jet formed during the collapse of a cavitation bubble:

> The control and direction of the re-entrant micro-jet formed during the collapse of a cavitation bubble can provide a powerful tool for performing various fabrication and manipulation functions at a submicron and nanometer scale.
>
> Col. 4, ll. 3-7.

> Studies by a number of authors have revealed that one significant element in producing the damage caused by cavitation occurs when a cavitation bubble collapses in the vicinity of a surface, launching what is called a re-entrant micro-jet toward the surface. This liquid jet can produce velocities as high as 1500 m/s, and is capable of damaging the hardest materials known.
>
> Col. 1, ll. 36-43.

Examiner attempts to find the above mentioned limitation in Figures 3-6 and column 6, line 38 to column 9, line 14 of LeClaire. Office Action, February 5, 2007. This discussion of LeClair, however, is directed to sequences that direct re-entrant micro-jets toward work surfaces.

The collapse of the bubbles of LeClaire does not result from the propagation of acoustic waves that exert radiation forces at exterior surfaces of the bubbles. Rather,

> The cavitation bubble, formed from the rapid expansion of vaporized fluid and the momentum of liquid moving away from the center of the focus volume, reaches a maximum diameter at the end of the expansion process. Typically, the maximum diameter of the fully expanded cavitation bubble is approximately 10 to 50 times the diameter of the focus volume, and is determined by amount of energy absorbed by the fluid in the focus volume. Not all the energy introduced into the focus volume is absorbed by the fluid. The amount actually absorbed depends on the chemical characteristics of the fluid and the coupling efficiency of a particular energy source. Gas pressure inside fully

> expanded cavitation bubble may be as low as the vapor pressure of the fluid at it's bulk temperature. This is due, in part, to the momentum of the expansion process which does not terminate when the bubble reaches an internal pressure equal to that of the surrounding fluid, but continues until the pressure is reduced to the vapor pressure of the surrounding liquid. The pressure of the surrounding fluid, typically at 1 atmosphere absolute or higher, creates a pressure differential on the outer surface of the cavitation bubble, driving its subsequent collapse. For fluids such as water at 1 atmosphere and 25.degree. C., the pressure differential can exceed 700 torr.
>
> Col. 4, ll. 32-54.

Furthermore, the mechanism by which the bubbles of LeClair collapse causes the destruction of the bubbles. See Figures 3-6. Moreover, the micro-jet formed by the collapse of the bubbles of LeClair, as explained above, is a liquid jet. A liquid jet is not an acoustic wave and does not exert a radiation force. As explained above, a radiation force is due to the absorption or reflection of an acoustic wave.

The dependent claims are patentable because they depend from one of the independent claims.

Applicant's Attorney submits that the claims are in a condition for allowance. Applicant's Attorney respectfully requests a notice to that effect. Applicant's Attorney also invites a telephone conference if Examiner believes it will advance the prosecution of this case.

Please charge any fees or credit any overpayments as a result of the filing of this paper to Deposit Account Number 02-3978.

Respectfully submitted,

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Appendix

T. G. Leighton, The Acoustic Bubble, Institute of Sound and Vibration Research, The University, Southampton, UK, 1994, pp. 19-22.

E. Unger, et al., Microbubbles in molecular imaging and therapy, Medicamundi 47/1, April 2003, pp. 58-65.